Work, Energy, Power Review:

- Work: $W = F d \cos\theta$

  work is the "same" as the force

  net force → net work
  applied force → applied work
  force of friction → work from friction

- Energy: we focused on mechanical

  - Kinetic: $K = \frac{1}{2} m v^2$

  - Gravitational potention: $U_g = m a_g h$

    We will always choose the ∅ point as the lowest point in the problem.

- Work – Energy theorem: $W = \Delta E$

  $$F d \cos\theta = \frac{1}{2} m (v_f^2 - v_i^2) + m a_g (h_f - h_i)$$

  - We use this when a nonconservative force causes a change in velocity or height

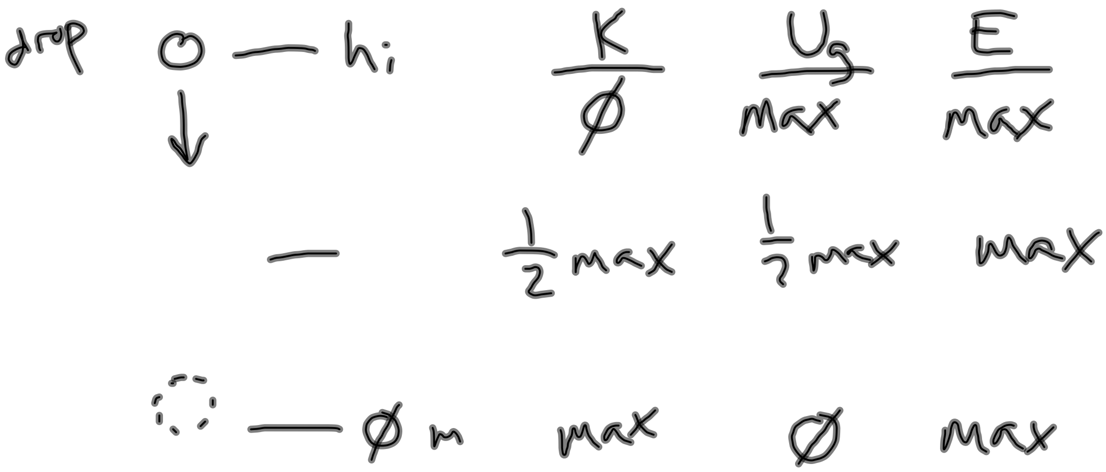
- Conservation of Energy: $E_i = E_f$

  $$\frac{1}{2} v_i^2 + a_g h_i = \frac{1}{2} v_f^2 + a_g h_f$$

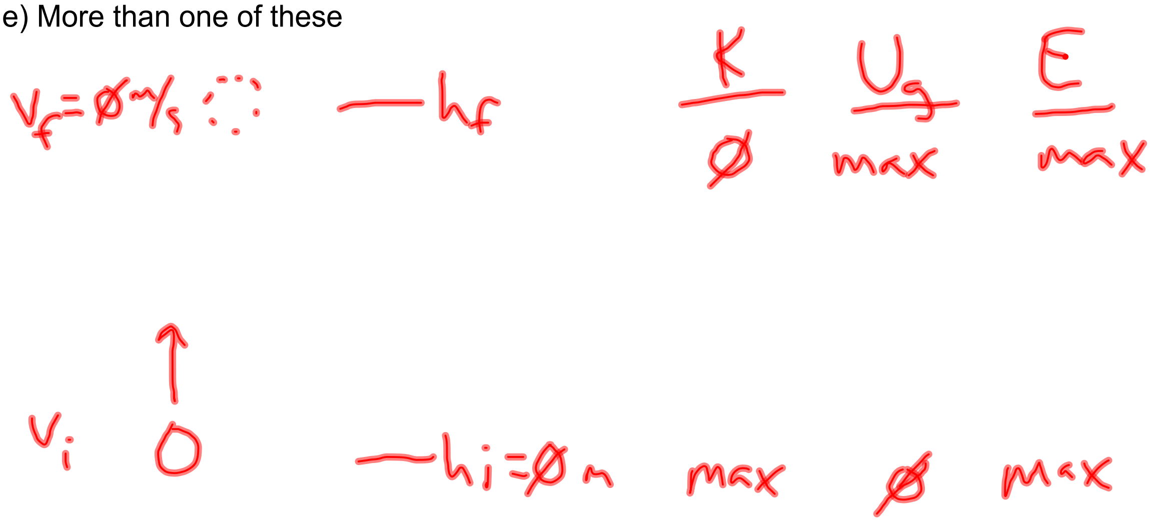
- Power: how quickly you do some amount of work

  $$P = \frac{W}{t} = F v$$

Review and Practice Problems 4.23.12 Honors Physics



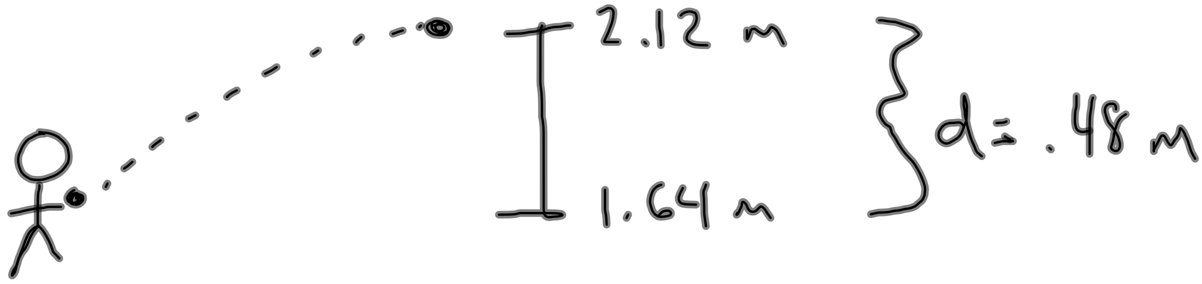
If you throw a ball upwards, the kinetic energy it has as it leaves your hand is equal to
a) zero.
b) the work it took to walk the ball horizontally to the spot where you throw it from.
c) the potential energy at the top of the flight (from hand-throw level).
d) the kinetic energy it will have at the top of the flight.
e) More than one of these



At a certain point in an intense footrace, an average sized armadillo and an average sized mouse are moving at the same velocity. Which of the following are true at this point?
a) The mouse is currently in the lead
b) Both of these amazing creatures have the same kinetic energy currently.
c) Both of them have the same amount of momentum.
d) If their velocities hold the same for a few seconds, the armadillo will be more powerful during that time.

Review and Practice Problems 4.23.12 Honors Physics

A shot-putter puts a shot (weight = 71.6 N) that leaves his hand at a distance of 1.64 m above the ground. Find the work done by the gravitational force when the shot has risen to a height of 2.12 m above the ground.



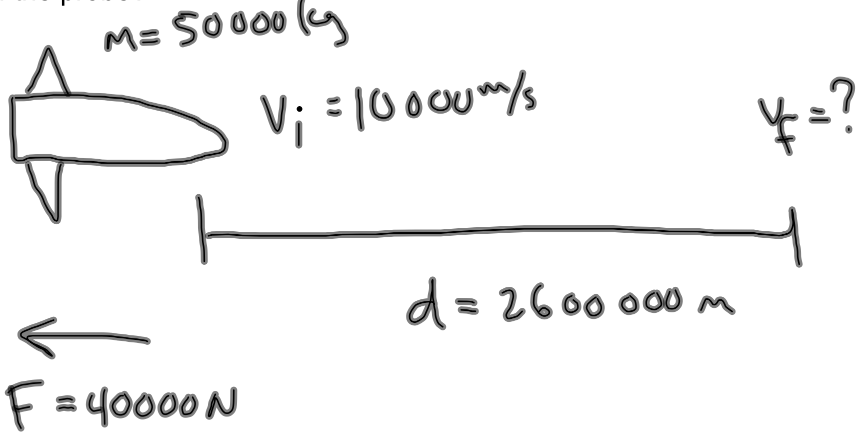
$$W_g = F_g d \cos\theta$$

$$= (71.6\ \text{N})(.48\ \text{m})\cos(180°) \quad [\cos(180°) = -1]$$

$$= -34.4\ \text{J}$$

Review and Practice Problems 4.23.12 Honors Physics

A 50000 kg space probe is traveling at a speed of 10000 m/s through deep space. Retrorockets are fired along the line of motion to reduce the probe's speed. The retrorockets generate a force of 40000 N over a distance 2600 km. What is the final speed of the probe?



$$W = \Delta E$$

$$F d \cos\theta = (K_f - K_i) + (U_{gf} - U_{gi}) \rightarrow 0$$

$$F d \cos\theta \rightarrow -1 = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

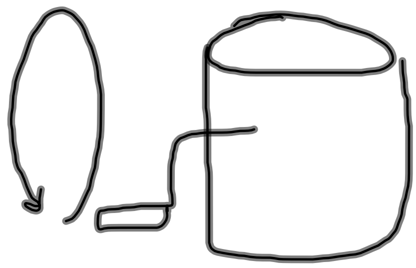
$$\frac{1}{2} m v_f^2 = \frac{1}{2} m v_i^2 - F d$$

$$v_f = \sqrt{v_i^2 - \frac{2Fd}{m}}$$

$$= \sqrt{(10000\ m/s)^2 - \left[\frac{2(40000\ N)(2.6E6\ m)}{50000\ kg}\right]}$$

$$\approx 9789.8\ m/s$$

A person is making homemade ice cream. She exerts a force of magnitude of 22 N on the free end of the crank handle, and this end moves in a circular path of radius 0.31 m. The force is always applied parallel to the motion of the handle. If the handle is turned once every 1.2 s, what is the average power being expended?



d = circumference

$= 2\pi r$

$$P = \frac{W}{t}$$

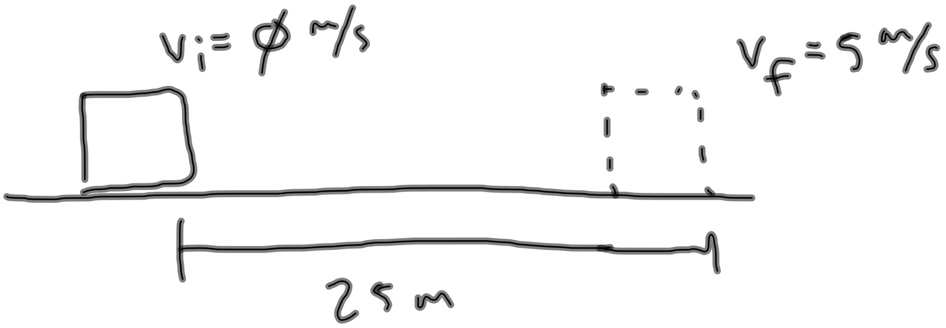
$$= \frac{F\,d}{t}$$

$$= \frac{(22\ N)(2)(\pi)(.31\ m)}{1.2\ s}$$

$$= 35.7\ W$$

Review and Practice Problems 4.23.12 Honors Physics

A box with mass of 10 kg is pulled from rest to a velocity of 5 m/s over a displacement of 25 m along a horizontal floor. The coefficient of friction is 0.17 between the box and floor. Find the horizontal applied force necessary to pull the box to this velocity.



$\mu_k = .17 \quad m = 10\ kg$

$$W_{net} = \Delta E$$

$$F_{net}\, d \cos\theta \ (\rightarrow 1) = (K_f - K_i \ (\rightarrow \emptyset)) + (U_{gf} - U_{gi}) \ (\rightarrow \emptyset)$$

$$(F_A - F_{fk})\, d = \frac{1}{2} m v_f^2$$

$$F_{fk} = \mu_k F_N = (.17)(98\,N) = 16.66\,N$$

$$F_A - F_{fk} = \frac{m v_f^2}{2d}$$

$$F_A = F_{fk} + \frac{m v_f^2}{2d}$$

$$= 21.7\,N$$